Peculiar, Junior-Sized Supernova Discovered by New York Teen

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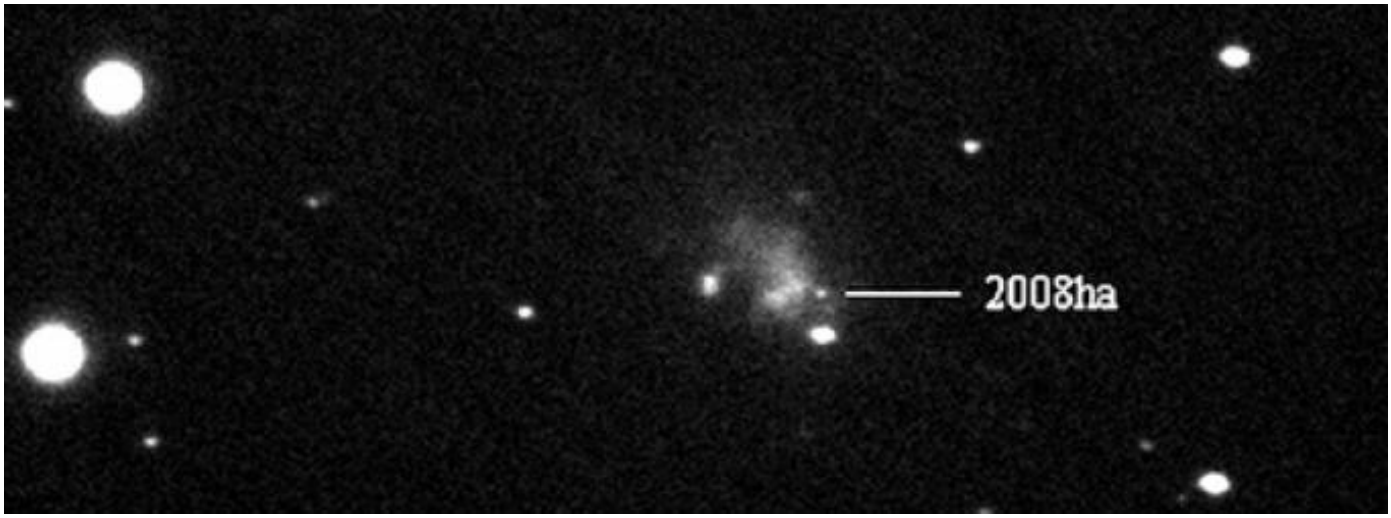

Cambridge, MA In November 2008, Caroline Moore, a 14-year-old student from upstate New York, discovered a supernova in a nearby galaxy, making her the youngest person ever to do so. Additional observations determined that the object, called SN 2008ha, is a new type of stellar explosion, 1000 times more powerful than a nova but 1000 times less powerful than a supernova. Astronomers say that it may be the weakest supernova ever seen.

Even though this explosion was a weakling compared to most supernovae, for a short time SN 2008ha was 25 million times brighter than the sun. However, since it is 70 million light years away, it appeared very faint viewed from Earth.

The peculiar object effectively bridged the gap between a nova (a nuclear explosion on the surface of an old, compact star called a white dwarf) and a type Ia supernova (the destructive death of a white dwarf caused by a runaway nuclear reaction starting deep in the star). SN 2008ha likely was a failed supernova where the explosion was unable to destroy the entire star.

"If a normal supernova is a nuclear bomb, then SN 2008ha is a bunker buster," said team leader Ryan Foley, Clay fellow at the Harvard-Smithsonian Center for Astrophysics and first author on the paper reporting the findings. "From one perspective, this supernova was an underachiever, however you still wouldn't want be anywhere near the star when it exploded."

Caroline was able to discover the object using a relatively small telescope, but some of the most advanced

telescopes in the world were needed to determine the nature of the explosion. Data came from the Magellan telescopes in Chile, the MMT telescope in Arizona, the Gemini and Keck telescopes in Hawaii, and NASA's Swift satellite.

In typical supernova explosions, light from different chemical elements (such as calcium or iron) is smeared out across the electromagnetic spectrum by the Doppler effect (the same principle that makes a police siren change pitch as it passes). Because the ejected bits of the star were "only" moving at 4.5 million miles per hour (compared to 22 million miles per hour for a typical supernova), the light wasn't as smeared out, allowing the team to analyze the composition of the explosion to a new precision.

"You can imagine many ways for a star to explode that might resemble SN 2008ha," said Robert Kirshner of the Harvard-Smithsonian Center for Astrophysics. "It could have been a massive star suddenly collapsing to form a black hole, with very little energy leaking out. But it looks a lot like its brighter cousins, which we think are nuclear explosion of white dwarfs. Maybe this one was an explosion of that general type, just much, much weaker."

One reason astronomers haven't seen this type of explosion before might be because they are so faint. "SN 2008ha was a really wimpy explosion," said Alex Filippenko, leader of the University of California, Berkeley supernova group, which monitors thousands of relatively nearby galaxies with a robotic telescope at Lick Observatory in California. But a new generation of telescopes and instruments is beginning to search greater distances than ever before, effectively monitoring millions of galaxies. Foley's team concludes that hundreds of this type of event may be spotted in the next few years.

"Coincidentally, the youngest person to ever discover a supernova found one of the most peculiar and interesting supernovae ever," remarked Filippenko. "This shows that no matter what your age, anyone can make a significant contribution to our understanding of the Universe."

The paper has been accepted for publication in the Astronomical Journal and is available online at http://arxiv.org/abs/0902.2794.

Other coauthors of the paper are Ryan Chornock, Mohan Ganeshalingam, Weidong Li, Bradley Cenko, Maryam Modjaz, and Jeffrey Silverman of UC Berkeley, Peter Challis and Andrew Friedman of the Harvard-Smithsonian Center for Astrophysics, and Michael Wood-Vasey of the University of Pittsburgh. The research was supported in part by the National Science Foundation, the Sylvia and Jim Katzman Foundation, and the TABASGO Foundation.

Headquartered in Cambridge, Mass., the Harvard-Smithsonian Center for Astrophysics (CfA) is a joint collaboration between the Smithsonian Astrophysical Observatory and the Harvard College Observatory. CfA scientists, organized into six research divisions, study the origin, evolution and ultimate fate of the universe.

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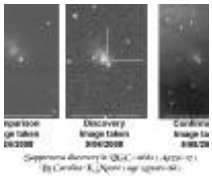

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